# Notes on Ustilagineæ.

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WITH PLATE XVIII.

DOASSANSIA OPACA Setchell occurs on *Sagittaria variabilis* at Providence, R. I., and at New Haven, Conn.

D. OCCULTA (Hoffm.) Cornu has been collected on *Potamogeton Claytonii* at Cold Spring Harbor, N. Y., by Mr. Thomas Morong and at Bridgeport, Conn., by the writer.

D. MARTIANOFFIANA (Thuem.) Schrœter has been found growing on the leaves of species of Potamogeton in Marl pond, Courtland county, N. Y., by Prof. C. H. Peck and in great abundance by the writer in Twin lakes, Salisbury, Conn., in a pool near North Haven, Conn., and in lake Whitney near New Haven, Conn. The species of Potamogeton have not been carefully determined for these specimens but they were certainly not *P. Claytonii* in any case.

The occurrence of D. Martianoffiana as a probably not uncommon American species is assured by these discoveries and it is to be hoped that the germination of the spores may be observed and its relationship to D. occulta more satisfactorily determined. As far as the information at present is concerned there seems to be good reason for still keeping it distinct from D. occulta. The two species have in common the structure of the sorus and similar host-plants. I have, however, never found them either upon the same species of Potamogeton or in the same locality. The presence of conidia in D. Martianoffiana as shown by Prof. Peck's specimens, as well as the difference in habit, also point towards a distinction between the two.

D. DEFORMANS Setchell has proved to be of rather wide distribution in the United States. It has been collected in Missouri by Rev. C. H. Demetrio and in South Dakota by Mr. T. A. Williams. For specimens from these localities I am indebted to the kindness of Dr. O. Pazschke and Prof. W. G. Farlow. I have also collected it near Providence, R. I., and New Haven, Conn.

**Doassansia intermedia,** sp. nov. — Spot inconspicuous, light-yellow to brownish, circular, one-fourth to one-half inch

in diameter. Sori hypophyllous, in the spongy parenchyma of the leaf-blade, decidedly ellipsoidal, 200–260$\mu$ long and 120–160$\mu$ thick. Outer covering of two or three layers of semigelatinized hyphæ usually present at maturity. Cells of the cortex more or less flattened, sometimes closely crowded together, sometimes more loosely placed with moderately thick brown walls. Spores globular, or nearly so, 6–8$\mu$ in diameter, in several irregular layers just underneath the cortex, not readily separable by crushing. Germination? Central portion of the cortex made up of thin-walled parenchymatous cells almost destitute of solid contents.

On leaves of *Sagittaria variabilis.* Shelburne, N. H., *W. G. Farlow!* Port Arthur, Minn., *F. W. Dewart!* August to October.

D. intermedia is the sixth member of the Doassansia group and the fifth of the genus to be found upon Sagittaria variabilis. In structure of the sorus it comes very near to the species of the subgenus *Doassansiopsis;* but instead of the spores being situated in a single regular layer underneath the cortex as they are in D. occulta, D. Martianoffiana, and D. deformans, in D. intermedia they are in several (2–5) irregular layers. Consequently it seems best to emend the character of the subgenus as follows:

DOASSANSIOPSIS.—Central portion of the sorus consisting of parenchymatous cells. Spores in one or more layers, inseparable at maturity. Cortex distinct.

D. intermedia also resembles *Burrillia pustulata* Setchell very much in general habit and structure but differs from it in the possession of a distinct cortex.

D. PUNCTIFORMIS Winter.—Niessl gave the name *Protomyces punctiformis* in 1872 to a fungus on *Butomus umbellatus.*[1] Schrœter referred Niessl's plant to the genus Doassansia as *D. punctiformis* in 1887.[2] In the meantime Winter[3] had bestowed the name *D. punctiformis* upon an Australian species inhabiting the leaves of *Lythrum hyssopifolia.* De Toni in his review of the genus[4] names *Protomyces punctiformis* Niessl, *D. Niesslii* and retains the name D. punctiformis for Winter's species. Magnus has recently[5] proposed the

[1] Verhandl. d. Naturf. Ver. i. Brünn, **10:**—.
[2] Pilzfl. Schles., 287.
[3] Rev. Myc., 207. 1886.
[4] Journ. Myc., **4:** 17, 1888 and in Saccardo, Syll. Fung. **7:** 505. 1888.
[5] Abhandl. d. Botan. Ver. d. Prov. Brandenburg, **32:** 253. 1890.

name *D. Winteriana* for the *D. punctiformis* Winter, deciding to retain Schrœter's name for *Protomyces punctiformis* Niessl.

The writer, however, has shown[6] that *Protomyces punctiformis* Niessl is not a Doassansia since the sori lack the cortex which Cornu considered the distinguishing mark of the genus, but that it is to be referred to the genus Entyloma. Consequently, the name *Doassansia punctiformis* belongs to the Australian species, of which, as Prof. Magnus kindly informs me, there is no specimen in Winter's herbarium. This prevents determining accurately whether *D. punctiformis* Winter, in turn, is a true Doassansia or not.

D. GOSSYPII Lagerheim.—Through the kindness of Prof. Lagerheim the writer has been able to examine specimens of this species. The sori occur in the spongy parenchyma of the leaf and are at first globular and wholly immersed. This is apparently the state seen by Prof. Lagerheim. Later however the sori break through the epidermis, the coating of hyphæ bursts open, and the spores are seen to be arranged in vertical rows, supported below upon sterile cells. The structure is not that of a Doassansia but more like that of some species of rust. The species may be referred provisionally to the genus Chrysomyxa, as **Chrysomyxa Gossypii** (Lagerh.).

CORNUELLA LEMNÆ Setchell has been detected by the writer at Providence, R. I. and New Haven, Conn. A careful search among the dying fronds of Spirodela will probably show that it is a widely distributed species.

ENTYLOMA COMPOSITARUM Farlow was found by the writer, growing in abundance on *Aster Novi-Belgii* at Peaks island, Maine, in October, 1889.

The spores from the fresh material germinated readily in water and gave rise to promycelia 12–17$\mu$ in length and about 2.5$\mu$ in diameter. Each promycelium produced three, four or five sporidia, which were about 15$\mu$ long, of almost equal diameter (about 2$\mu$) throughout their length, and blunt at each end. The sporidia produced germ tubes without falling from the promycelia. No conjugation was observed but such conditions as that shown in figure 8 seem to indicate that it takes place. Spores sown from dried material in late October and in November failed to germinate.

ENTYLOMA CRASTOPHILUM Sacc. is the species to which

[6] Annals of Botany, 6: 38. 1892.

the *Ustilago lineata* Cke. is referred at present. It is a very common form near New Haven, upon the leaves of *Zizania aquatica.* The spores are dark and form elongated sori in the leaf tissue. They germinated rather freely when sown in water in May, 1892. The promycelium reached a length of from 25$\mu$ to 80$\mu$. The sporidia were usually four in number. They do not seem to conjugate but produce buds from the distal end both before and after falling from the promycelia.

RHAMPHOSPORA NYMPHÆÆ Cunningham is described as occurring in leaves of different species of *Nymphæa* in India. What appears to be exactly the same thing has been found by the writer growing in leaves of *Nuphar advena* near New Haven, Conn., and in leaves of *Nymphæa odorata* at Ledyard, Conn., and at Woods Holl, Mass. Sowings were made in water both from fresh and from dried material but were unsuccessful.

Cunningham[7] separates this species from the genus Entyloma and makes it the type of the new genus Rhamphospora, because all the spores are borne at the tips of hyphal branches and because the promycelium is subverticillately branched.

A comparison between Cunningham's figures[8] and those of the germination of the spores of *Entyloma Magnusii* as figured by Woronin[9] and that of the spores of *Doassansia obscura* as given by the writer[10] will show that the "branches" of the promycelium are indeed primary sporidia and the fact that they do not conjugate, while the bodies produced from them do, is hardly sufficient for classifying them as peculiar structures. In many of the species of Entyloma and Doassansia the primary sporidia do not conjugate, yet there is no reason for considering them to be promycelial branches, for they arise in exactly the same way that the primary sporidia which conjugate do. The fact that these "promycelial branches" are finally septate is not in the way of their being considered primary sporidia, for the primary sporidia of many species of Entyloma and Doassansia are finally septate. The regular conjugation between what Cunningham calls the primary sporidia is peculiar but hardly sufficiently characteristic to be regarded as a generic rather than a specific distinction.

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[7]Scientif. Mem. of the Med. Officers of the Army of India, *3*. 32. 1888.
[8]Loc. cit. *pl. 2. figs. 7–16.*
[9]Beitr. z. Kenntn. d Ustilagineen, *pl. 4, figs. 24–26.*
[10]Annals of Botany **6:** *pl. 1. figs. 37–42.*

The development of the spores has not been studied very carefully in any species of Entyloma, yet it is known that in some species at least they are subterminal as well as intercalary. Consequently, it seems best to regard this form as **Entyloma Nymphææ** (Cunningham) rather than as the type of a distinct genus.

The common barnyard grass is the host-plant of two pulverulent smuts, the one *Tolyposporium bullatum* Schrœter, the other *Ustilago sphærogena* Burrill. The distortions produced by these two species are very similar in shape and size and I was much interested to find both of them in the same locality at Woodmont, near New Haven, Conn., and even in the same inflorescence.

TOLYPOSPORIUM BULLATUM Schrœter inhabits the ovaries of *Panicum Crus-galli* causing them to swell to several times their normal size. The surface of the swollen ovary is smooth and shining and the Tolyposporium may thus readily be told from the Ustilago on the same host. It is, therefore, not a very conspicuous species, but is apparently fairly common in the New England states. The spores are agglomerated into balls and germinate readily in water at almost any season. A longer or shorter promycelium is produced and from this, sporidia bud off either terminally or laterally. Secondary sporidia are produced from these, tertiary are produced in turn, and so on until very complex branching forms result. The type of germination is of the Ustilago- as opposed to the Tilletia-group, but the germination of Tolyposporium bullatum differs very decidedly in its details from that of *T. Junci* as Woronin represents it.[11]

USTILAGO SPHÆROGENA Burrill causes distortions of the spikelets of *Panicum Crus-galli* which in size and shape closely resemble those produced by the preceding species. The more luxuriant specimens, however, reach a somewhat greater size than those of the Tolyposporium and the surface of the distortion, instead of being smooth and shining, is rough, with short, rigid hairs. This is accounted for by the fact that the upper glumes and palets as well as the ovary are infected and distorted by the fungus.

The spores are free and germinate readily on being sown in water on a slide. Sometimes sporidia were produced when the promycelium has reached a length of a few micromilli-

[11] loc. cit. *pl. 4, figs. 5–8.*

meters but often the promycelium reaches a length of from 48$\mu$ to 50$\mu$ before sporidia are produced. The promycelia grow obliquely up toward the surface of the water on the slide and some of the sporidia project above the surface into the air. On looking down upon a slide covered with germinating spores, these projecting sporidia form perfect thickets. The chains of sporidia readily fall to pieces and continue to bud until the whole slide is covered with yeast-like cells.

Germinations were obtained from sowings made in February, May and October.

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EXPLANATION OF PLATE XVIII.

Fig. 1. *Doassansia intermedia* sp. nov. Portion of a median section through a sorus. × 700.—Figs. 2, 3, and 4. *Tolyposporium bullatum* Schrœter. Promycelia and sporidia. × 1000.—Figs. 5, 6 and 7. *Ustilago sphærogena* Burrill. Promycelia and sporidia. The dotted line in fig. 6 represents the surface of the water. × 1000.—Fig. 8. *Entyloma Compositarum* Farlow. Promycelium with sporidia producing germ-tubes. × 1000.